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Страх гипогликемии у пациентов с сахарным диабетом 1 типа

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Независимо от причин и факторов риска развития гипогликемии, ее проявления всегда неблагоприятны и закономерно вызывают отрицательные эмоции и страх, что приводит к негативным последствиям в отношении контроля сахарного диабета (СД). Боязнь гипогликемии создает внутренний конфликт, снижая мотивацию к использованию интенсивных режимов инсулинотерапии. Кроме выраженности гипогликемии и ее негативных последствий, одним из главных параметров оценки физической, психологической и социальной составляющих жизни пациента в целом является качество жизни, а страх гипогликемии – это один из самых главных факторов, напрямую или опосредованно влияющий на все аспекты жизни пациента. Страх гипогликемии также является источником тревоги для близких пациента, нанося ущерб семейным и социальным отношениям. Негативные последствия гипогликемий влияют не только на супружеские отношения, но и на взаимоотношения родителей и детей с СД 1 типа (СД1). Качественные и количественные исследования демонстрируют данные о том, что нетяжелые гипогликемии, возникающие в ночные часы, доставляют больше тревожных переживаний и страха пациентам, чем гипогликемии, возникающие днем. Для количественной оценки страха гипогликемии у взрослых пациентов с СД1 разработана шкала страха гипогликемии (hypoglycemia fear scale, HFS), которая до сих пор остается наиболее часто используемым и актуальным инструментом. Для оценки страха гипогликемии у детей и родителей шкала HFS была адаптирована для использования в педиатрической популяции – HFS для родителей (PHFS) и HFS для детей (CHFS). С клинической точки зрения, подобные шкалы для измерения уровня страха гипогликемии могут быть полезны для мониторинга взрослых пациентов и семей, которым, возможно, требуется дополнительная поддержка, образование или помощь в решении вопросов, касающихся гипогликемии. Методы воздействия на страх гипогликемии варьируют от поведенческих до фармацевтических и хирургических и включают достаточно большой спектр мероприятий. Тем не менее, проблема остается достаточно актуальной, и на сегодняшний день и подход к ее решению, как со стороны доктора, так и со стороны пациента, должен быть комплексным. Правильная оценка уровня тревожности пациента, влияния страха гипогликемии на социальную жизнь, осознание возможных психологических последствий этого вопроса могут позитивно воздействовать как на поведение и настроение пациента, так и на возможность добиться лучшего гликемического контроля.

Ключевые слова: *гипогликемия; последствия гипогликемии; страх гипогликемии; шкалы оценки страха гипогликемии; терапевтическое обучение пациентов*

Fear of hypoglycaemia in patients with type 1 diabetes

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Independently of causes and risk factors of hypoglycaemia, its manifestations are always unfavourable and evoke fear and other negative emotions that lead to negative consequences connected with quality of diabetes control. The fear of hypoglycaemia creates an internal conflict by diminishing patients' motivation to adhere to intensive treatment regimes. In addition to the severity of hypoglycaemia and its negative consequences, quality of life is one of the main criteria for evaluating the physical, psychological and social components of patient's life as a whole. Fear of hypoglycaemia is one of the most important factors; it either directly or indirectly affects quality of life and influences all aspects of the patient's life. Fear of hypoglycaemia is also a source of anxiety for the patient's relatives, causing damage to their familial and social relations. The negative consequences of hypoglycaemia can affect the relationship between spouses, as well as between parents and children with type 1 diabetes. The qualitative and quantitative data demonstrate that non-severe nocturnal hypoglycaemia causes more anxiety and fear in patients than daytime hypoglycaemia does. To quantify the fear of hypoglycaemia in adults with type 1 diabetes, the hypoglycaemia fear scale (HFS) was developed and still is the most commonly used instrument. To assess the fear of hypoglycaemia in children and their parents, the HFS scale was adapted to be used in the paediatric population: HFS for parents (PHFS) and HFS for children (CHFS). From a clinical point of view, these scales for measuring the level of fear of hypoglycaemia may be useful for monitoring adult patients and families who may need additional support, training or assistance in dealing with issues related to hypoglycaemia. The methods for regulating the fear of hypoglycaemia range from behavioural to pharmaceutical and surgical ones, and include a broad range of activities. Nevertheless, the problem remains quite relevant today and an integral approach for solving this problem, both by the physician and by the patient, should be used. Proper assessment of the patient's level of anxiety, impact of the fear of hypoglycaemia on his or her social life, awareness of

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the possible psychological consequences of this problem may positively affect both the behaviour and mood of the patient, and the opportunity to achieve better glycaemic control.
Keywords: *hypoglycaemia; consequences of hypoglycaemia; fear of hypoglycaemia; hypoglycaemia fear scales; therapeutic patient education*

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The psychological component in the treatment of diabetes mellitus (DM) is one of the most important aspects of therapy, and hypoglycaemia, the most common side effect of insulin therapy and one of the limiting factors for achieving the target levels of blood glucose is one of the most important parts of the psychological component.

Hypoglycaemia can occur at any time of the day; it is often unpredictable and affects intellectual and physical activities by interfering with the daily life of the patient and the people around him/her. Regardless of the causes and risk factors of hypoglycaemia, its symptoms are adverse and cause fear and other negative emotions that lead to negative outcomes. In addition, the experience of severe hypoglycaemia requiring the intervention of another person or medical personnel may affect patient's behaviour in the future through his/her attempts to avoid such conditions and result in difficulties in achieving optimal glycaemic control.

Fear of hypoglycaemia creates an internal conflict by diminishing the patients' motivation to adhere to intensive insulin treatment despite the fact that patients recognise the importance of that strategy for prevention of chronic complications of DM [1].

However, the degree to which it influences the psychological life of a patient depends on the severity of hypoglycaemic manifestations.

DEFINITION AND CLASSIFICATION OF HYPOGLYCAEMIA

The American Diabetes Association (ADA) [2] defines the following types of hypoglycaemia:

Severe hypoglycaemia:
- an event requiring the assistance of another person for administration of carbohydrates, glucagon or other emergency care,
- can lead to a coma,
- measurement of plasma glucose levels during this episode may be available/unavailable and
- neurological recovery associated with an increase in glucose levels to normal values.

Confirmed symptomatic hypoglycaemia:
- typical symptoms of hypoglycaemia and
- accompanied by decreased plasma glucose levels of ≤3.9 mmol/l.

Asymptomatic hypoglycaemia:
- no hypoglycaemic symptoms and
- accompanied by decreased plasma glucose levels of ≤3.9 mmol/l.

Probable symptomatic hypoglycaemia:
- typical hypoglycaemic symptoms,
- measurement of blood glucose levels not performed and
- hypoglycaemic symptoms presumably caused by glucose levels of ≤3.9 mmol/l.

Relative hypoglycaemia:
- typical hypoglycaemic symptoms and
- interpreted by the patient as hypoglycaemia when glucose levels are >3.9 mmol/l.

According to the data from the **European Agency for Evaluation of Medicinal Products** (EMEA) [3], there are 3 types of hypoglycaemic episodes:

1) severe hypoglycaemic episodes:
- osymptomatic episodes requiring assistance because of impairment of consciousness or behaviour, with blood glucose levels of <3.0 mmol/l and
- recovery after administration of glucose or glucagon.

2) minor hypoglycaemic episodes:
- osymptomatic/asymptomatic episodes with blood glucose levels of <3.0 mmol/l and
- no need for physical assistance.

3) putative hypoglycaemic episodes:
- ocases where blood glucose levels cannot be determined.

The Canadian Diabetes Association *(CDA)* includes the following symptoms in the definition of hypoglycaemia [4]:
- development of autonomous or neuroglycopenic symptoms,
- plasma glucose levels of <4.0 mmol/l in patients receiving insulin or insulin secretagogues and
- disappearance of symptoms after administration of carbohydrates.

The 'Diabetic-Specific Algorithms', the national standards of diagnosis and treatment of diabetes in the Russian Federation, provide a biochemical definition: 'hypoglycaemia is when plasma glucose level is < 2.8 mmol/l, accompanied by clinical symptoms, or < 2.2 mmol/l, regardless of symptoms * (*—unified definition of hypoglycaemia does not exist)' [5].

Furthermore, the Russian standards differentiate between mild hypoglycaemia, which does not require the

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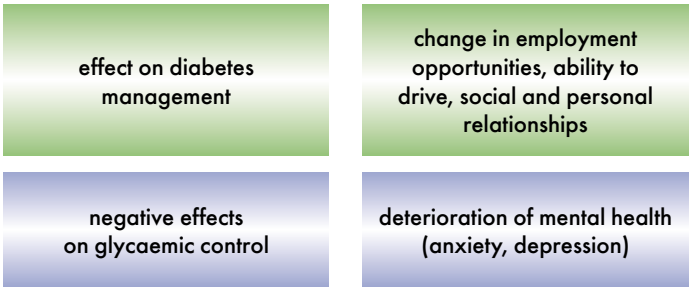

Figure 1. Clinical manifestations of fear of hypoglycaemia

assistance of another person, and severe hypoglycaemia, which requires the assistance of another person (with loss of consciousness or without it).

Thus, independent of the classification used, the differentiation between mild and severe hypoglycaemia, which depends on whether the assistance of another person is required to treat the episode and the frequency of episodes of hypoglycaemia, allows us to evaluate the 'imprint' on the psychological and psychosocial aspects of a patient's life (Fig. 1).

FREQUENCY OF HYPOGLYCAEMIA

The frequency of hypoglycaemic episodes has been studied, mainly in patients with type 1 diabetes mellitus (T1DM), and severe hypoglycaemia has been predominantly investigated. The Diabetes Control and Complications Trial (DCCT) is often believed to be the most accurate source of information about the frequency of severe hypoglycaemia in patients with T1DM. The prevalence of severe hypoglycaemia events according to the DCCT results (36% per year) [6] correlated with the results obtained in other large-scale trials (30%–40%) [7, 8]. These cases can be relatively easily estimated retrospectively because the memories of such events in patients with normal sensitivity to hypoglycaemia persist for a year. However, total amnesia after severe hypoglycaemia is a relatively common situation; therefore, the estimation of the frequency of hypoglycaemia in patients with impaired sensitivity and with frequent episodes of severe hypoglycaemia is quite difficult. For these patients, more detailed information can be provided by relatives [1]. Moreover, the data obtained by Hendrieckx confirmed the obvious association between the fear of hypoglycaemia, emotional background and diabetes-associated quality of life in patients who experienced severe hypoglycaemic episodes with a loss of consciousness [48].

In the total population of patients, the frequency of severe hypoglycaemia increases with the increased duration of DM [48]. This was clearly demonstrated in a large prospective evaluation in the United Kingdom (UK Hypo Group 2007) [9]; in patients diagnosed with T1DM for over 15 years with satisfactory glycaemic control (average HbA_{1c} levels of 7.6% after a year of evaluation), the incidence of severe events was several times higher than that in patients studied in DCCT. The distribution of events among patients was relatively uniform; only a small proportion of patients experienced multiple episodes of severe hypoglycaemia. However, a large-scale study conducted in Sweden in 2010 (n = 764) demonstrated that the frequency of severe hypoglycaemia was one of the most important factors directly associated with the fear of hypoglycaemia [49].

Mild hypoglycaemia managed by patients can significantly vary in the severity of symptoms. Within a week, the patient loses details about the event. An interesting fact was shown by European comparative prospective studies; despite significant changes in the pharmacodynamics of insulin and the insulin regimens, the average number of mild hypoglycaemic episodes per week remained unchanged for over 20 years (approximately 2 episodes per patient per week) [10, 11].

EFFECTS OF HYPOGLYCAEMIA

According to Frier [12], the effects of hypoglycaemia can be differentiated as follows:

Early effects:
- anxiety,
- transient cognitive dysfunction,
- depersonalisation,
- apathy,
- loss of control,
- guilt, frustration,
- tightness,
- dependence on other people and
- accidents.

Remote effects:
- stress,
- behaviour characterised by an attempt to avoid hypoglycaemia,
- compulsive self-monitoring of blood glucose,
- problems in relationship with other people,
- problems at work/school,
- guilt, frustration,
- social isolation and
- organic cognitive dysfunction.

Except for the severity of hypoglycaemia and its negative effects, one of the main parameters for assessing the physical, psychological and social components of the patient's life is the quality of life [13].

Factors affecting the quality of life in patients with diabetes mellitus

- dietary restrictions,
- self-management and treatment, often imposing a heavy load on the patient (time and high psychological stress associated with continuous monitoring of the disease),
- threat of complications, which provokes anxiety and

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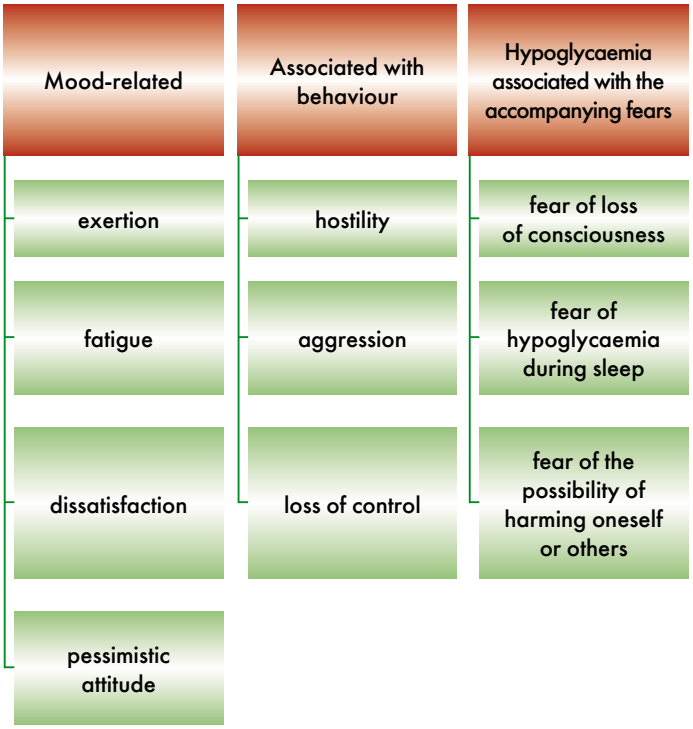

Figure 2. Reasons for fear of hypoglycaemia.

depression, and in the future, when they develop, a significant reduction in the patient's ability to function in daily life and
- communication difficulties associated with the fear of rejection by others, fear of job loss and problems within the family.

One of the most important factors affecting the quality of life is also the fear of hypoglycaemia, which either directly or indirectly affects all aspects of a patient's life.

In terms of the possible causes of the fear of hypoglycaemia, some reasons are obviously directly related to mood and behaviour as well as various fears accompanying hypoglycaemia (Fig. 2).

Most patients experiencing frequent severe hypoglycaemic episodes suffer from psychological deterioration, anxiety, depression and fear of future hypoglycaemia. Fear of hypoglycaemia is also a source of **anxiety for the patient's relatives,** thus damaging family and social relations.

Spouses of patients that experience frequent severe hypoglycaemic episodes have been shown to suffer major anxiety, fear and sleeping disorders compared with spouses of patients with satisfactory glycaemic control [14, 15]. In another study assessing family relationships, two-thirds out of 60 spouses of patients with T1DM reported that the risk of severe hypoglycaemia was their main source of worry and anxiety [16].

The negative consequences of hypoglycaemia not only affect marital relations but also the relationship between parents and children with T1DM.

According to various studies, including DCCT, the risk of hypoglycaemia in ***children and adolescents*** is higher than that in adults; the frequency of severe hypoglycaemia is also higher regardless of the mode of insulin therapy (conventional or intensive). A prospective study including 657 children with T1DM showed evidence of a higher incidence of hypoglycaemia in children younger than 6 years compared with the older age groups [17]. Eating disorders are also a common problem, mainly among adolescents with T1DM [18]. The eating behaviour in this age group of patients is characterised by eating disorders, whereas diabetes management requires food awareness and calculation. Emphasis on exercise without adequate self-control of glucose levels and unpredictability in the management of hypoglycaemia can lead to repeated episodes of hypoglycaemia and various attempts to combat obesity, which can cause the dangerous development of bulimia [19]. Hypoglycaemia in younger children is usually caused by a specific behaviour characterised by the discordance of meal and physical activity and insulin concentrations. The complexity is determined by both frequent snacking and eating due to the social environment. Physical activity can also be unpredictable. The most common cause of hypoglycaemia in young patients is physical activity; however, unfortunately, some patients and their parents try to reduce this risk by excessive carbohydrate intake before, during and after exercise [20, 21].

FEAR OF NOCTURNAL HYPOGLYCAEMIC EPISODES

We should not forget about the impact of nocturnal hypoglycaemic episodes on the daily life of patients. Kaufman et al used continuous glucose monitoring (CGM) to demonstrate that nocturnal hypoglycaemia causes special psychic tension in children and their parents [22]. Earlier studies using CGM demonstrated a high frequency of nocturnal hypoglycaemia in children; the level of nocturnal hypoglycaemia varied from 14% to 47% [23]. In addition, the DCCT study showed that more than half of the severe hypoglycaemic episodes occurred at night, and in younger patients, 75% episodes occurred at night [17, 24]. Fear of nocturnal hypoglycaemia is most likely to affect parents actively involved in monitoring DM in their children at night. For example, parental fear of nocturnal hypoglycaemia often leads to increased self-monitoring of blood glucose at night, increasing the stress and anxiety of the parents [25]; in extreme cases, the parents try to maintain higher blood glucose levels.

The data from many studies suggest that non-severe hypoglycaemic events occur in 24%–60% patients with DM [10, 26, 27]. Qualitative and quantitative studies show that non-severe hypoglycaemia occurring at night causes more anxieties and fear in patients than hypoglycaemia occurring during the day. The influence of nocturnal hypoglycaemia on the productivity of patients on the following day compared with hypoglycaemia occurring during working hours was also noted. Moreover, such events affect the quality of life and the overall glycaemic control and therefore act as

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barriers to the organisation of the therapeutic process. Brod et al [28] studied non-severe nocturnal hypoglycaemic events (NSNHE) and defined such events as 'nocturnal hypoglycaemic events that occur during sleep but do not require medical assistance from another individual, are accompanied by symptoms of hypoglycaemia or are registered as the result of the measurement of blood glucose in the absence of symptoms'.

The results of this study led to the conclusion that the classification of hypoglycaemia into non-severe and moderate is not quite correct, because such hypoglycaemia has 2 phases: acute (at the time of recognition and alleviation) and recovery (the time required to return to the normal rhythm of life). The acute stage is very short and easy to handle, whereas the recovery stage takes the entire next day for most patients. The impact of such events on sleep also has consequences; sleep disorders can lead to increased body mass index and obesity [29], disruption of insulin sensitivity [30], high blood pressure and/or cardiovascular events [31]. In a previous study, 10.4% of the studied patients were not able to sleep after an episode of hypoglycaemia at night; 70.4% patients felt weak and tired during the next day and 15.8% patients reduced their dose of insulin the next day, which increased their blood glucose levels and impaired their optimal glycaemic control [28].

QUANTIFICATION OF FEAR OF HYPOGLYCAEMIA

To quantify fear of hypoglycaemia ***in adult patients with T1DM,*** the Hypoglycaemia Fear Survey (HFS) was developed in 1987 [32]; this survey is still the most commonly used instrument. HFS measures several aspects of fear associated with hypoglycaemia and its negative consequences, including behavioural, subjective psychological and physiological responses [33]. HFS is composed of 2 subscales. The first subscale is Behaviour (HFS-B), which describes the behaviours in which patients may engage to avoid hypoglycaemic episodes and/or their negative consequences. The second subscale is Worry (HFS-W), which describes the specific concerns that patients may have about their hypoglycaemic episodes. In adults, fear of hypoglycaemia is closely linked to the history of severe hypoglycaemia, risk of its occurrence, decreased sensitivity to hypoglycaemia and disappearance of the precursory symptoms. Nevertheless, the measured level of fear does not necessarily remain stable; it can either increase or decrease over time depending on the actual or perceived risk of the patient. For example, fear can worsen after a particularly traumatic episode of hypoglycaemia or it can decrease after medical or psychotherapeutic intervention. Fear of hypoglycaemia is also associated with the personal level of anxiety in adults. In particular, patients with higher levels of anxiety, as indicated by their behaviour over a wide range of situations, also tend to have a more pronounced fear of hypoglycaemia. From the perspective of the impact of fear on the control over DM, the studies performed did not provide conclusive results allowing one to determine an association between higher levels of fear of hypoglycaemia and worsening control of DM [20]. In order to assess the ***fear of hypoglycaemia in children and their parents,*** HFS was adapted for use in the paediatric population. HFS for parents (PHFS) and HFS for children (CHFS) have the same structure of scales as HFS (behaviour scale and worry scale). The CHFS version consists of 10 points in the subscale CHFS-B (e.g. 'to keep the blood glucose level slightly higher to feel safe') and 15 points in the subscale CHFS-W (e.g. 'problems at school are due to my low glucose level'). The version for parents includes the following questions in the B scale (e.g. 'I try not to leave my child alone when I suspect that his/her glucose is likely to be low') and 15 points in the W subscale (e.g. 'I worry when my child does not have food or fruit juice') [34].

Several studies using the parent scale have shown higher levels of fear of hypoglycaemia in mothers whose children have experienced a loss of consciousness because of hypoglycaemia and mothers concerned with the hypoglycaemia of their children, which occurred at night or in social situations [35]. There is also some evidence that the maternal fear of hypoglycaemia is higher when multiple injection therapy is used in children than when the insulin pump therapy is used, which was confirmed by a multicentre study conducted in Germany. The study involved 117 children, 25 children aged 8–11 years, 63 adolescents aged 12–16 years and their parents and 29 parents of children aged 4–7 years who completed standard questionnaires about their quality of life, educational process, eating behaviour, fear of hypoglycaemia and family relationships before and 6 months after switching to insulin pump therapy. After switching to continuous subcutaneous insulin infusion (CSII), a significant improvement in the quality of life in all age groups was demonstrated; the effect was more pronounced in the older age group. Parents reported that because of CSII, they found it easier to raise their child and had reduced fear of hypoglycaemia [36].

More than one study has demonstrated that the maternal fear of hypoglycaemia was significantly higher than the paternal fear. Like in adults with T1DM, there is an assumption that an extreme degree of fear of hypoglycaemia in either parent or child may prevent optimal disease management. The behaviour of families with very high levels of fear is aimed at the prevention of hypoglycaemia, which leads to more frequent excesses in the target level of glycaemia. However, a study on this issue provided contradictory results. If a significant fear of hypoglycaemia leads to more frequent hyperglycaemia, HbA_{1c} levels should be higher, and in some studies, the absence of an association between maternal or a child's fear of hypoglycaemia and HbA_{1c} levels was demonstrated [37, 38].

From a clinical point of view, such studies and scales for measuring the level of fear of hypoglycaemia in general may be useful for monitoring adult patients and families who may need additional support, education and assistance in resolving hypoglycaemia-related problems. This is also essential for establishing the standard levels of fear of

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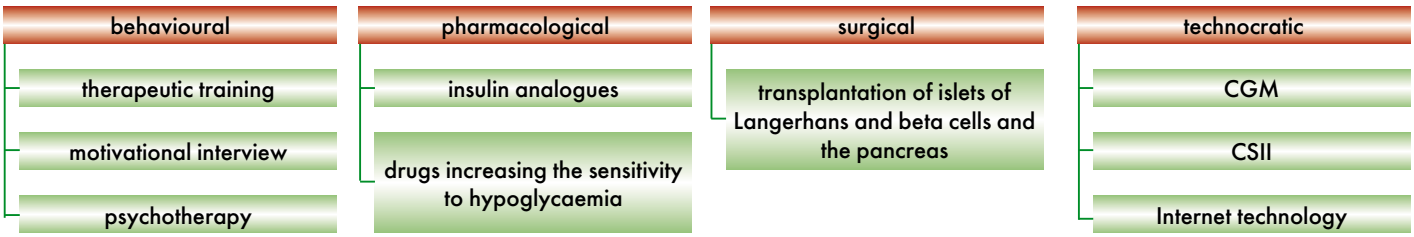

Figure 3. Methods to reduce fear of hypoglycaemia.

hypoglycaemia. Taking into consideration the potential risk of hypoglycaemia, some level of fear is appropriate; thus, it is important to evaluate the characteristics showing a healthy level of concern and to identify those indicating possible problematic levels of fear. The highest levels of fear were demonstrated among parents whose children lost consciousness because of hypoglycaemia. This suggested that families that recently experienced a traumatic hypoglycaemic episode may be most vulnerable to increased fear and should be assessed for reactions that may degrade the quality of life or disease control. Fear of hypoglycaemia should also be evaluated in families with high levels of anxiety, even if they have not experienced traumatic episodes of hypoglycaemia, because predisposition to anxiety or worry about an event before it actually occurs is much higher in such families [20]. This assumption was also confirmed by Patton who assessed the level of parental stress and its relationship with depressive symptoms and fear of hypoglycaemia in parents of children with T1DM. The results of this study demonstrated a higher level of stress and symptoms of depression for parents who constantly experienced fear of hypoglycaemia [50].

However, till date, there are no reliable data about the direct correlation between fear of hypoglycaemia and quality control of DM, because this relationship is highly complex. In some parents, a high level of fear of hypoglycaemia can lead to avoidance behaviours and high blood glucose levels, whereas in others, it may be associated with an increased risk of hypoglycaemia in a child, secondary to tight control of DM.

METHODS TO REDUCE FEAR OF HYPOGLYCAEMIA

Despite the prevalence and negative impact of fear of hypoglycaemia in patients with DM in the paediatric population, virtually no studies describing interventions aimed at reducing the fear in this population have been conducted. In adult patients, such actions have been aimed at reducing the risk of severe hypoglycaemia, which can positively influence the fear of hypoglycaemia. These measures range from behavioural to pharmaceutical and surgical and include training, therapy by insulin analogues and islet cell transplantation (Fig. 3) [39, 40].

One would expect that the fear of hypoglycaemia would be reduced with the increased frequency of using CGM—devices with an alarm that alerts of impending hypoglycaemia; however, the results of studies have been contradictory. Thus, the Juvenile Diabetes Research Foundation (JDRF) study [41] with CGM and real-time data broadcasting (notification about blood glucose levels outside the target values) involving 322 people of different age groups was performed. A group that used a sensor and a group using standard self-control were compared for 26 weeks. There was significant improvement in HbA_{1c} levels without an increased frequency of hypoglycaemia among patients older than 25 years; a modest improvement was observed for the age group of 8–14 years, but no improvement was detected in the age group of 15–24 years. Similar results were obtained by Markowitz et al in a study conducted in 2012. In this study, 28 children (8–17 years), 28 parents (71% mothers) and 21 adult patients were investigated. In a crossover study over a 6-month period, all participants were randomly assigned to 2 groups according to the method of monitoring: CGM and standard monitoring of blood glucose levels. The researchers found that there were no differences in the degree of fear of hypoglycaemia in the studied groups, although the parents in both groups reported more fear of hypoglycaemia compared with adolescents. In the younger group of patients who used CGM, the level of anxiety (both social and personal) was higher than that in the same age group who used standard monitoring of blood glucose levels [51]. Thus, we can conclude that with adolescents, there is difficulty involving the personal accommodation of the requirements of modern technology due to the need for continuous involvement of the patient in disease control. However, these studies did not fully focus on the direct effect of CGM on patients with frequent or severe episodes of hypoglycaemia or in patients with high levels of anxiety or fear. In the future, it may become possible to study the impact of other new technologies that can reduce the risk of hypoglycaemia, including the use of insulin pumps that shut themselves off when the patient's blood glucose levels are low and 'artificial pancreas' systems. As for the impact of psychosocial parameters of glycaemic control, the authors of these studies, as well as the authors of many studies conducted earlier, agree with each other. The subjective experience of hypoglycaemia depends on daily blood glucose levels. Increased glucose levels can falsely enhance sensitivity to hypoglycaemic symptoms, causing deterioration of general glycaemic control by preventive action. On the other hand, tight glycaemic control leads to a loss of sensitivity to hypoglycaemia, a reduced ability to recognise its symptoms and a higher risk of significant decrease in blood glucose levels. Thus, good glycaemic control may turn out to be a 'Pyrrhic victory' [52].

Notably, however, the positive results of the methods

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for reducing the frequency of severe hypoglycaemia in young patients, as shown by Nordfeldt et al [42], do not necessarily require very complex programs or technologies. The wide use of educational and training materials, including videos designed to teach families to prevent hypoglycaemia, reduced the frequency of severe hypoglycaemia by nearly 2-fold and prevented an increase in hypoglycaemia for several years. These results suggested that we cannot underestimate the possibility of developing and implementing interventions that may be effective at reducing the frequency of hypoglycaemia and its negative consequences, including the fear of hypoglycaemia itself. In addition to the actions to reduce the risk of hypoglycaemia, there is also a need for interventions that directly address the fear of hypoglycaemia, which can occur regardless of the actual risk of hypoglycaemia or the history of previous episodes.

With respect to the existing interventions, they are mainly of 2 types: ***psychological and educational.***

One of the most important aspects is the engagement of the patient's family and surrounding persons in the educational and therapeutic process. Many studies indicate the importance of the 'family–patient' concept [19]. Thus, many behavioural interventions including younger patients are aimed at optimising adherence to the disease control of hypoglycaemia, and the negative effects require participation and training of family members. Such interventions are successful only when the patient with DM feels the benefits of understanding, support and skill acquisition by family members. The importance of family therapy was demonstrated in the study conducted by Wysocki et al. [43] who used Behavioural Family Systems Therapy for Diabetes (BFST-D). The goal of this method was to help parents and young people with DM to improve communication skills and problem solving and to minimise family conflict associated with the disease. This randomised controlled study of 104 families showed a significant improvement in the quality of family relationships, family communication and clinical outcomes in the control group with BFST-D educational support. Despite the fact that researchers continue to study the ways to optimise adherence to glycaemic control of patients with DM, adolescent patients with parental support in the disease control process have been known to have better clinical outcomes [44].

In addition, there is the concept of motivational interviewing. The desire to change the patient's behaviour often fails, because the patients are being forced; however, it is successful when the patient by himself can detect the discrepancy between his or her own desires and behaviour. The concept of motivational interviews was applied in a multicentre randomised, controlled trial in the UK [45]. In this study, a group of adolescents aged 14–17 years who had motivational interviews for 12 months were compared with a control group that had standard visits for the same period. Subsequently, both groups were followed-up for an additional year. At the end of the period, the average HbA_{1c} levels were significantly lower in the group that had motivational interviews compared with the control group; this difference was still apparent a year later. Significant differences in favour of the group with motivational interviews were also observed for the level of anxiety, including the fear of hypoglycaemia, the quality of life and the contention that self-management is important for diabetes control. This observation suggests that there may be a critical time when patients, for example members from the adolescent age group, realise a higher responsibility for self-control of the disease and may be susceptible to the interventions of physicians and family members.

Adherence to any treatment regimen or any psychotherapeutic treatment is particularly difficult if there is no regular patient–physician contact. A considerable number of studies have demonstrated that the greatest risks of both early and late diabetes complications are observed when the doctor–patient relationship is lost [46]. Because of the active use of modern technology in everyday life, one of the solutions to this problem is the introduction of the active use of social networks and other Internet technologies, not only for permanent contact but also for attracting patient's interest to the disease and acquisition of new information about it.

Summing up and evaluating the role of the psychological component of such diabetes complications as hypoglycaemia and fear experienced by a patient, it should be noted that this problem is still quite relevant today, and the solution to this problem requires a complex approach by both physicians and patients. Proper assessment of the patient's level of anxiety, influence of fear of hypoglycaemia on patient's social life and awareness of the possible psychological consequences of this issue may positively affect both patient's behaviour and mood as well as provide opportunities to achieve better glycaemic control [47]. An individual approach based on various psychosocial and anamnestic data (patient's age, duration of DM and degree of compensation, treatment adherence, family relationships, involvement of family members and others in the therapy, etc.) allows the use of different methods of educational or psychological intervention. Despite the fact that there are no unifying standards of care for such an important factor as fear of hypoglycaemia, the key solution is therapeutic training, which allows the patient to understand the mechanisms of hypoglycaemia, evaluate the manifestations of hypoglycaemia in a timely manner and control symptoms.

DISCLOSURE INFORMATION

The authors declare that there is no conflict of interest.

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